PHILIPS

MULTI-PURPOSE OSCILLOSCOPE CAMERA

PM 9380

9444 093 80011

P31 DEPT 226.

9499 440 05911 1/569/1/01

PHILIPS

MP MASTER
MA24640

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SERVICE

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equipment for science and industry

TEST AND MEASURING EQUIPMENT

PM 9380 Oscilloscope Camera

The type number PM 9373 for the reduction lens and clip is obsolete,
As from now on, the lens & clip combination will be supplied under service order number 5322 381 44018.

PM 9380 Oscilloskopkamera

Typennummer PM 9373 für die Reduktionslinse mit Klemme ist hinfällig geworden. Mit sofortiger Wirkung ist die Kombination Linse & Klemme unter Service-Bestellnummer 5322 381 44018 erhältlich.

PM 9380 Appareil de photographie d'oscillogrammes

Le numéro de type PM 9373 pour lentille de réduction et étrier n'est plus valable. L'ensemble lentille-étrier sera livré sous le numéro de commande service 5322 381 44018.

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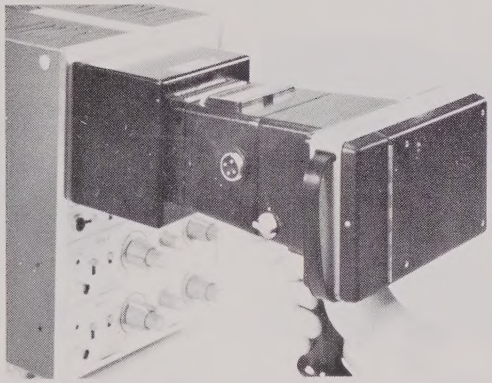

Manual

MULTI-PURPOSE OSCILLOSCOPE CAMERA PM 9380

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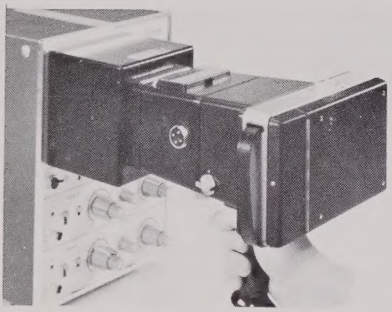

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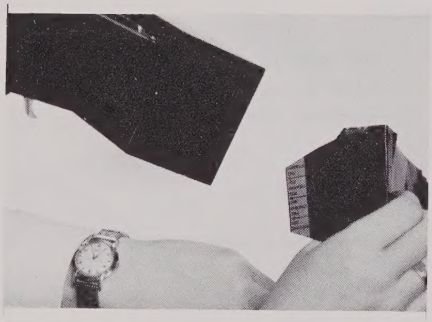

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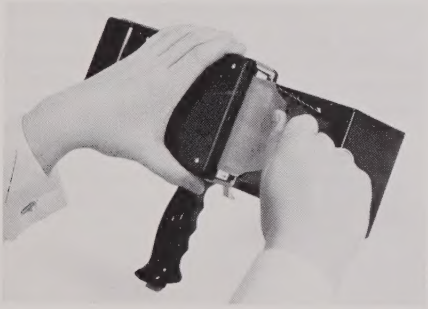

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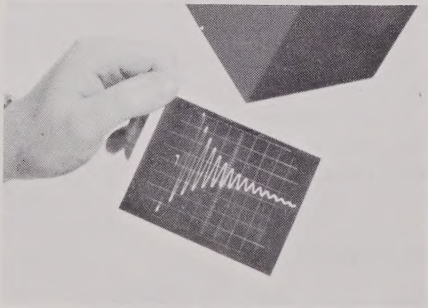

Oscillograms recorded in 20 seconds

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General

I. Introduction

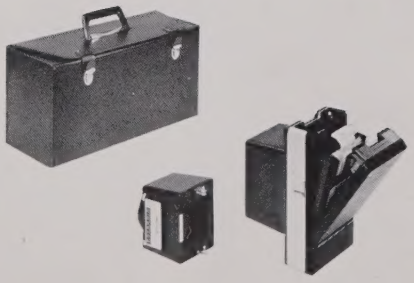
The multi-purpose oscilloscope camera PM 9380 incorporates the Polaroid instant photographic process. Apart from the unique advantage of seeing the picture only a few moments after taking it, this camera offers many other important features for oscilloscope trace recording:

- The camera does not have to be fixed on the oscilloscope; now the operator need only hold the camera combination against the screen, and pull the trigger. Seconds later he obtains a sharp, clear oscillogram.
- A cassette film is used for quick, convenient loading. It delivers a flat 8x10 cm (3¼x4¼ in.) picture.
- This big 8 x 10 cm print enables recordings on a 1 : 1 scale.
- Adaptors for various screen sizes and configurations can be mounted without difficulty.
- In addition to trace recording, this camera can also be used for close-up photographs of almost any object.

  In fact, the PM 9380, is so easy to operate, even for unskilled persons that it indeed encourages systematic recording.

Screen adaptors and supplementary lens must be ordered separately.

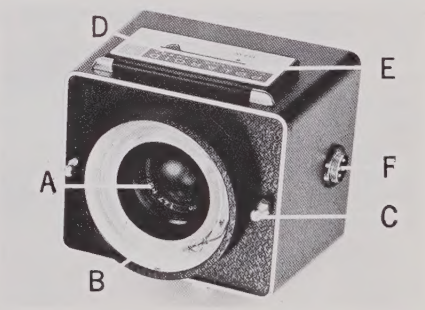
Type number PM 9380 consists of:
- Camera body
- Lens unit
- Carrying case
- Detailed handbook



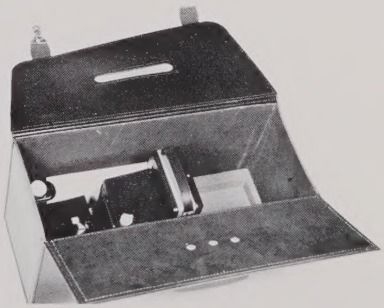
II. Main components

Camera body: It is designed for use only with Polaroid Land pack films, type 107 (black and white) and type 108 (colour). The lens unit is attached to the front of it. There is a pistol grip which screws into the body.

Lens unit: This consists of a 75 mm (3 in.), f/4.5, 4-element Rodenstock-Ysaron lens which is color-corrected and coated on all eight surfaces. A special Prontor shutter – with speeds from 1 second to 1/125th second, plus "T" and "B" positions – is mounted between the elements of the lens. For explanation of the lettering, refer to page 13.



Ever-ready case: There is room for the camera, an adapter, and two film packs.



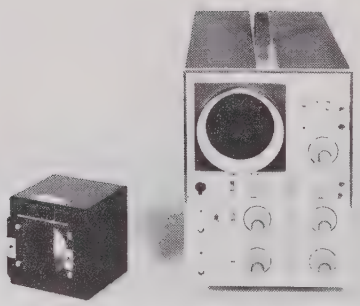
III. Optional accessories

SUPPLEMENTARY LENS

PM 9373: This lens gives a reduction of 1 : 0,9. It has to be used with the adaptors PM 9375, PM 9376 and PM 9377.

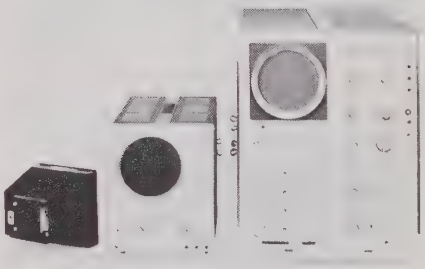
ADAPTORS:

PM 9374: This adaptor is designed for 10 cm dia CRT's. (PM 3230 – PM 3231)



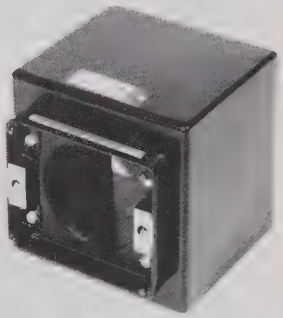
PM 9375: This adaptor is designed for 13 cm dia CRT's. (PM 3330 – PM 3220 – PM 3221)

Note: Supplementary lens PM 9373 required.



PM 9376: This adaptor is designed for 8 x 10 cm rectangular CRT's.

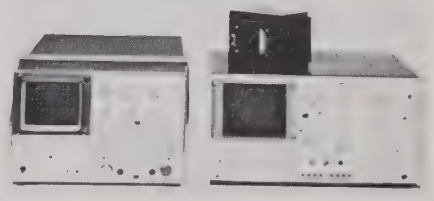
Note: Supplementary lens PM 9373 required.



PM 9377: This adaptor is designed for the PM 6507 and the PM 3410.

Note: Supplementary lens PM 9373 required.

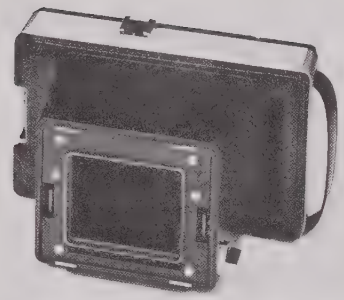
Connect the adaptors to the camera with the type plates facing downwards.



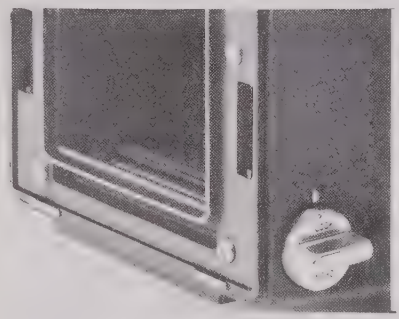
Directions for use

IV. The camera body

The camera body is provided with a light-tight door to prevent light from reaching the film, except when a lens unit is mounted on the camera. The door is opened and closed by turning the lock that holds the lens unit in place. When removing the lens unit, even when there is a film in the camera, the door automatically closes.

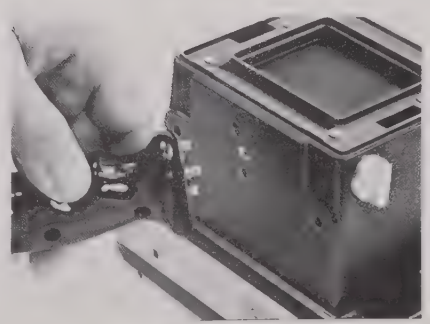


When a lens unit is mounted on the camera body the door opens automatically. Here the lock knob has been turned to LOCK position to show the door is open.

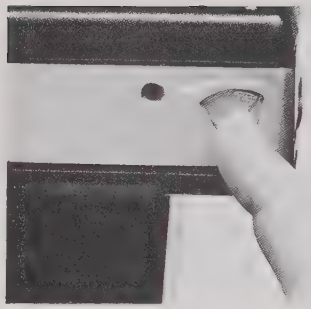


The camera is designed to be used hand held most of the time and a pistol-type hand grip is provided. The assembly is shown below.

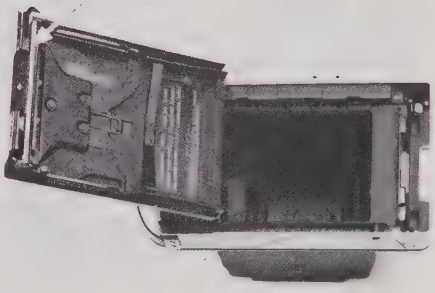
The hand grip screws into a standard tripod socket on the bottom of the camera body. Additional pins and holes prevent it from turning sideways.
When the camera must be mounted on a tripod, always use the same tripod socket to which you attach the pistol grip when the camera is hand held.
In addition to the tripod socket, there are several threaded holes in the camera body for attaching accessories.
Don't use these as tripod sockets.



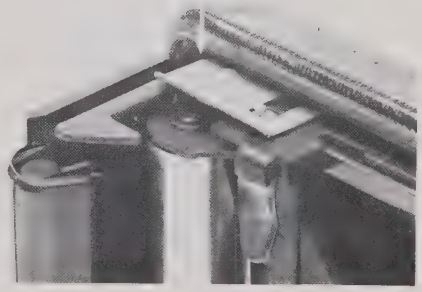
To open the back of the camera body, push the back door latch. The door will pop up.

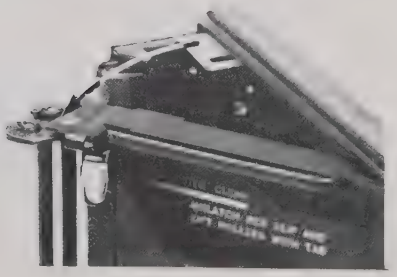


When the back door is fully open, you can see the steel rollers (arrow). These form an important part of the development of the pictures, you will find the explanation in sec. X.
In order to avoid picture problems, the rollers must be kept clean.
It is a good idea to inspect the rollers before loading a new film pack.



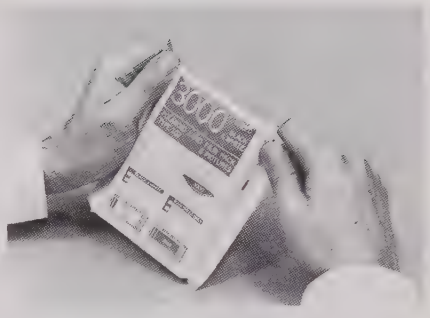
To inspect the rollers, lift up the red latch (arrow); you can then swing out the roller assembly. If the rollers are dirty, clean them as described in XXII. Push the assembly back into place.

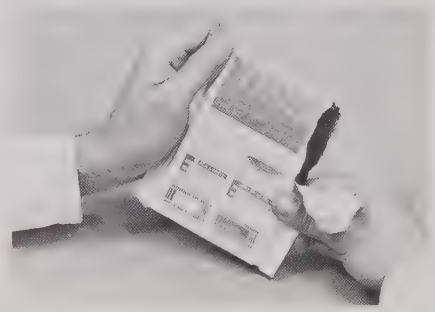




V. The film

The camera can operate with two kinds of pack film: Type 107-3000 ASA (36 DIN) black and white film, and Type 108-75 ASA (20 DIN) colour film. Each pack produces eight 8 x 10 cm (3¼ x 4¼ in.) prints.
In the Polaroid Land photographic process the chemicals necessary to develop the picture are in a thin container (pod) attached to the negative. Do not squeeze the middle of the packs; the pods may be damaged and your pictures will not be developed properly. Handle packs by the edges.
The development of the print is started by pulling a paper tab. The pictures develop outside the camera, as shown as in X.
Temperature (especially cold) can affect the way your picture develops and the quality of the print. Please read the instruction sheet packed with the film you are using for information about the importance of time and temperature during the development.
Recommendations for the exposure and development of the Polaroid Land films may change from time to time. The most up-to-date information is always the instruction sheet packed with the film you are using.

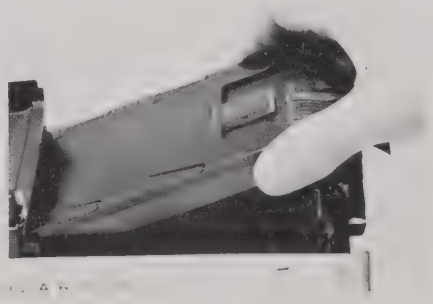




LOADING THE FILM INTO THE CAMERA

Remove the film pack from its box, holding it only by its edges. Never press hard on the middle of the package. Open the foil wrapper by tearing open the entire side of the package along the dotted line, as shown, starting at the corner. Remove the film pack and discard the moisture absorbing card packed with colour film. Handle the film by the edges ONLY.

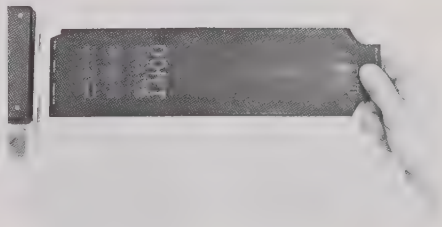
For loading, the camera body can be held in the left hand, or the front of the camera body can be rested on a table. If there is no lens unit on the camera be sure that the lock knob on the body is turned so that the word OPEN is opposite the mark. Turn the knob as far as it will go.
The adaptors and the guard surrounding the ring light are both made to support the weight of the camera. Thus, the camera may be rested lens down on a clean smooth surface for loading. It should of course be held steady while loading.



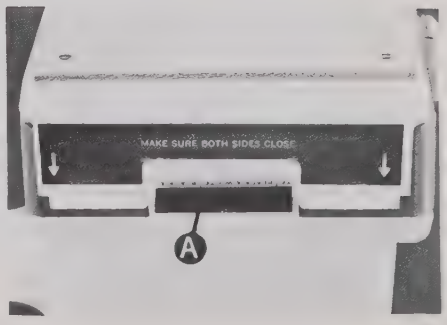
Hold the film pack so the printing on the black safety cover faces the lens.
Push the closed end of the pack under the door hinge against a light spring tension. Gently push the pack down into the camera; you will feel it snap into place. Make sure that the white tabs are free and are not folded under the pack.

Close the back door. Press both sides firmly together to be sure they lock. The black tab should be in the slot (a). If not, reopen the back door and place the black tab in the proper position; then close the back door again.

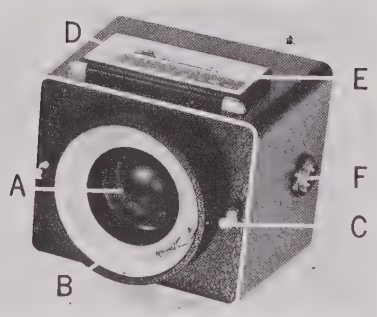
Pull the black safety cover all the way out of the camera without stopping.
Pull straight, and do not rip it.



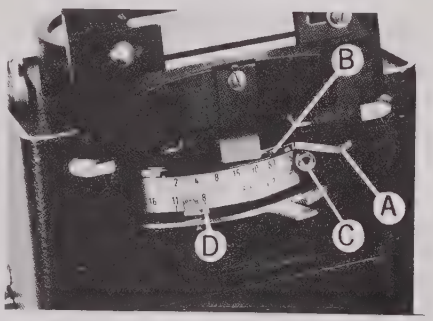
When the safety cover has been pulled out, a white tab (a) should stick out of the small slot. Do not pull the white tab this time. The camera is now loaded and the pack is ready for the first picture.
If no white tab is visible, do the following (but) shaded from clear light).
Partly open the back of the camera and without disturbing or moving the pack, push the white tab into the opening. Lock the back; check that the white tab is in the slot.



VI. The lens unit



Important parts are: (A) Rodenstock-Ysaron lens, 75 mm (3 in.), f/4.5 to f/45, (B) electronic flash ring light, (C) mounting post for adaptors and other accessories. (D) film selector lever and f-number controls, (E) access door to shutter controls.

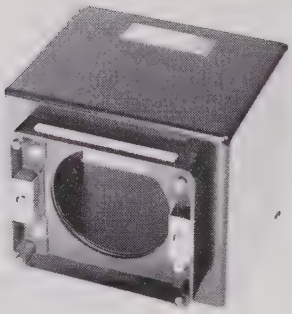


To reach the shutter controls you must open the access door. To open or close the access door you must set the film selector lever to the B&W position.
The Prontor shutter is of the self-cocking type; that is, it will function any time you pull the trigger without having to be cocked.
It has speeds from 1 sec. to 1/125 sec. and both "B" and "T" positions* for time exposures. Speeds are set by moving the lever (A) and are indicated by a red mark (B). A cable release socket is provided (C).
The film selector lever also controls the lens opening; f-number are indicated by a pointer (D).

* "B" position: pull the trigger and hold it, thus opening the shutter. The shutter closes when the trigger is released. ("B" means Bulb)

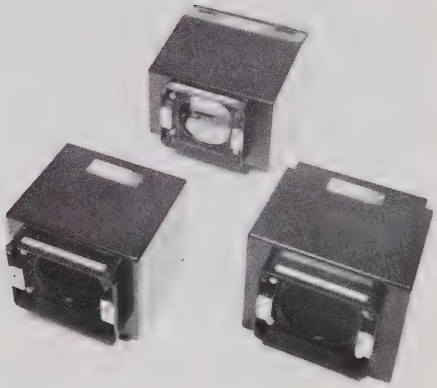
"T" position: pull the trigger, thus opening the shutter. The shutter is closed when the trigger is pulled a second time. ("T" means Time)

VII. The adaptors



For easy use the adaptors snap on the front of the lens unit.
When operating with adaptor PM 9374 you will obtain an oscillogram on a 1 : 1 scale.

When using the adaptors PM 9375, PM 9376, and PM 9377, a supplementary lens (PM 9373) is required to reduce the screen image slightly.



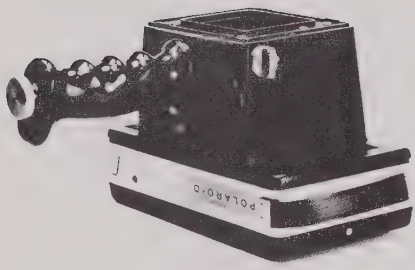
The adaptors and the supplementary lens must be ordered separately.

VIII. The supplementary lens PM 9373

This lens gives a reduction of 1 : 0,9.
A Filter Clip is provided, which holds the lens in place on the front of the lens unit.

IX. Assembly and use

Start by attaching the hand grip (unless you intend to use a tripod).
Then set the camera body on its back.

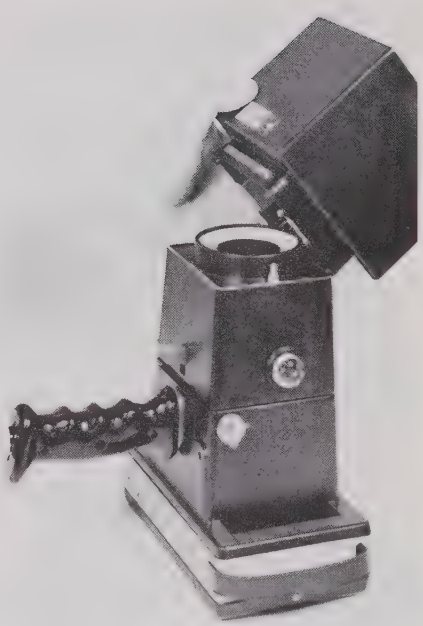


Place the lens unit on the camera body, connecting the ends of the latches, and press the unit into place.

Turn the lock knob to bring LOCK opposite the mark; turn it as far as it will go; you will then feel a final click.
Check that the lens unit is firmly attached.
(To disassemble the lens unit, turn the lock knob to OPEN position, lift the lens unit straight up).

Place the adaptor over the front of the lens unit and press it down onto the mounting posts; it will snap into place.

If adaptor PM 9375, PM 9376, or PM 9377 is used, it is necessary to use the supplementary lens. Bring this lens into place before connecting the adaptor.

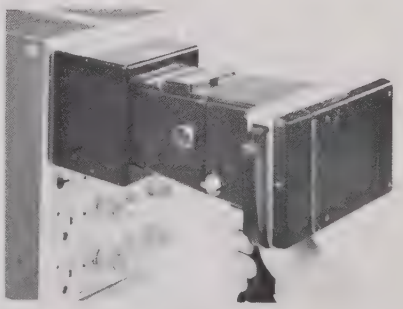


The supplementary lens is placed in front of the lens unit and retained by the Filter Clip, a springy split ring that expands against the housing of the lens unit.
The Filter Clip and the method of installation are shown on the right.

Place the camera on the oscilloscope. Do this carefully and then press it firmly against the front.

The four edges must be held in contact with the front of the instrument; otherwise you may get bad pictures.

The next step is to set the lens opening and shutter speed required.
Then pull the trigger and remove the camera from the oscilloscope.



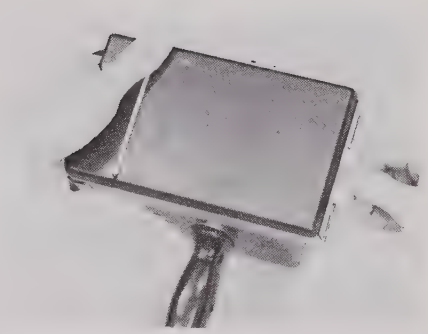
X. Processing pack film prints

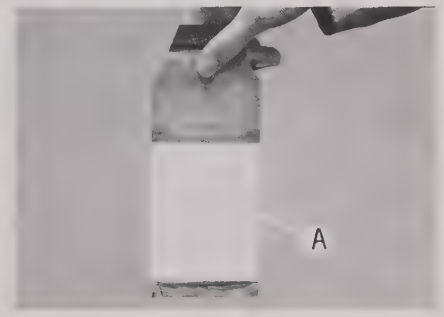
The prints develop outside the film holder.

1. Pull the white tab: After making the exposure, grasp the small white tab and pull it straight out of the film holder without hesitating. This causes a large yellow tab to appear.
Pulling the small white tab does NOT start the development. It only prepares the film for the next step, which is pulling the yellow tab.
If no yellow tab appears when you pull the white tab, stop. DO NOT pull another white tab. Follow the instructions on the next page.
Never pull a white tab when you can see a yellow tab.

2. Pull the yellow tab: Grip the yellow tab in the center and pull it moderately fast, without hesitating, straight out of the film holder. The picture is now developing OUTSIDE the film holder. Start timing as soon as you have pulled the yellow tab.

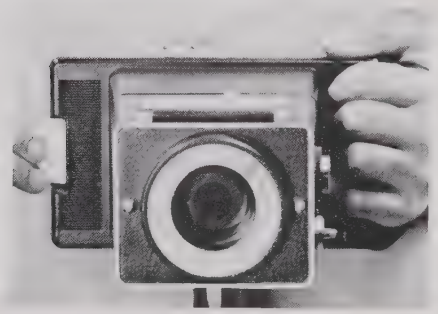
3. Wait the full recommended development time: This is specified in the instruction sheet supplied with each film pack.
During the development time, DO NOT touch, bend, or lift off the print (A).



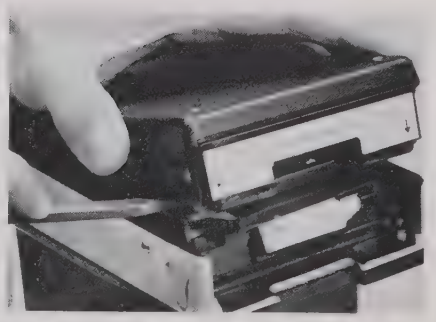


4. Lift off the print: After the full development time, quickly strip the print from the negative, starting at the end nearest the yellow tab. Never allow the print to drop back onto the damp negative.
Discard the negative. Avoid all contact with the chemicals left on the negative after the print is removed.
Coating prints: Prints made with Type 107-3000 ASA black and white film require coating. See your film instruction sheet for details. Never coat Polaroid colour prints.

Alternate methods of holding the camera during the processing of pack film prints.



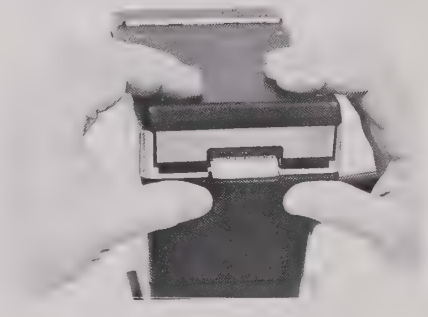
If no yellow tab appears when you pull the white tab:
Stop! DO NOT pull another white tab. Instead gently open the film holder just enough to get a pencil or similar object on top of the film pack, to hold it in place. Do this away from bright lights.



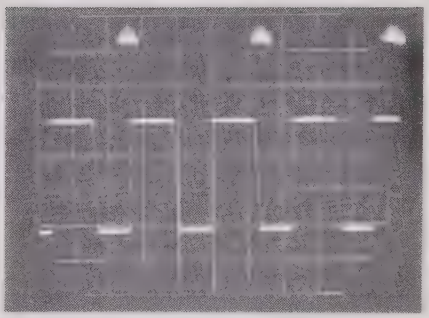
While holding the pack in place, as described, carefully open the film holder door all the way. Take hold of the topmost yellow tab.

Gently pull the tab to remove the entire picture assembly from the holder. Take care that the film pack stays firmly seated all the time.
The removed picture assembly is useless. Discard it.

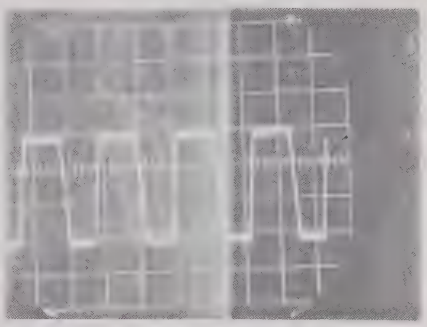
Close the film holder door, making sure that the next white tab sticks out of its slot. Check that both sides of the door latch securely.



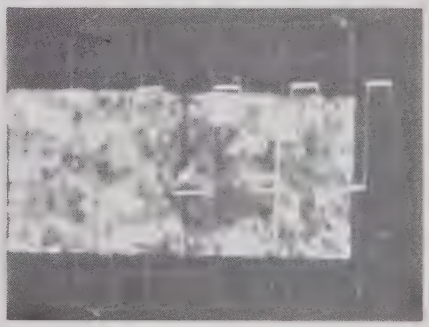
XI. Possible picture faults, their cause and cure



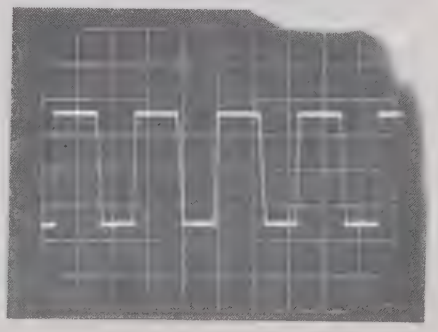
Repeated white spots:
Marks like these are due to dirt on the steel rollers in the film holder. Inspect and clean these rollers regularly.



Curtain-shaped mark or broad streak:
If the yellow tab is partly pulled and then briefly stopped, one of these marks will result. When the hesitation, occurs early in the pull, a curtain-shaped mark (A) along one of the narrow picture edges will occur. When the pull is stopped about half-way you are likely to get a broad streak (B), lighter than the surrounding picture tone, and running across the short width of the picture.
If the yellow tab is pulled too slowly, or with a series of yerks without actually stopping, the print will have a blotchy mottled appearance rather than the streak or curtain mark.
Always pull the tab out fairly rapidly in one smooth and uninterrupted motion.

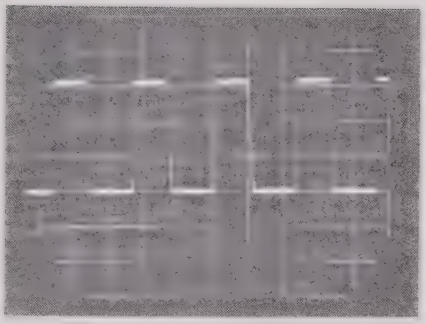


Oblong in the print:
The oblong, which will be pink or red in a color picture, indicates that you did not pull the white tab all the way out of the film holder. When you pulled the yellow tab, the white tab was pulled back into the holder, thus spoiling the picture. Always pull the white tab all the way out of the holder.



Undeveloped edges or corners:
These are usually caused by pulling the yellow tab out at an angle. This prevents the developer from being spread evenly over the picture, thus causing edges or corners to remain undeveloped. With colour film, pulling the yellow tab at an angle will generally result in orange-red marks along the edge or in a corner of the print.
Always pull the yellow tab straight and smoothly, all the way out.

Many small white specks:
With both black and white and color film, these are a sign that you pulled the yellow tab too swiftly. Pulling the yellow tab too fast can also cause pink lines, streaks, or blotches on colour prints.
Try to pull the yellow tab a little less rapidly.

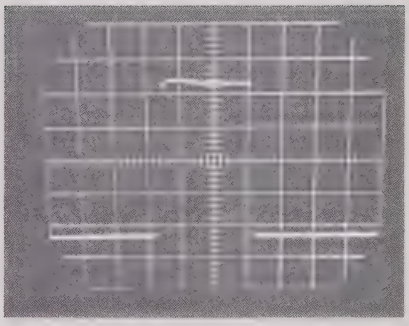


Muddy looking print:
The picture was not developed long enough. Develop both black and white, and colour film for the full time recommended in the film instruction sheet. Underdeveloped colour prints will tend to be a brownish pink.

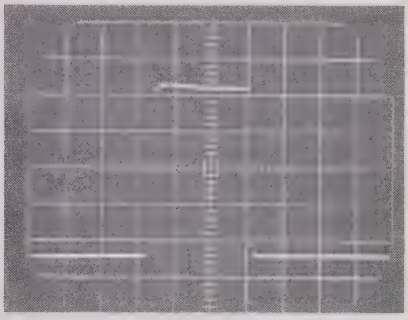
Very light image or none at all:
The film was greatly overexposed or it was accidently fogged. Check your exposure setting.
Both black and white film and colour film will be fogged if you pull out the safety cover before putting the film pack into the film holder, or if you remove the film pack from the holder after having pulled out the safety cover.

Nearly black image or solid black:
If no detail at all is visible, either your camera shutter or some other part of the image recording equipment did not function properly. Check that you have removed the safety cover.

Pciture out of focus
The picture on the right shows what happens when the camera is not held perpendicular to the front of the oscilloscope. In this picture the top side is clear and the bottom side narrower and blurred.

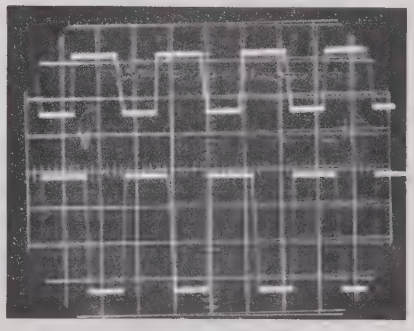


The second picture shows the result when your equipment has the right settings.

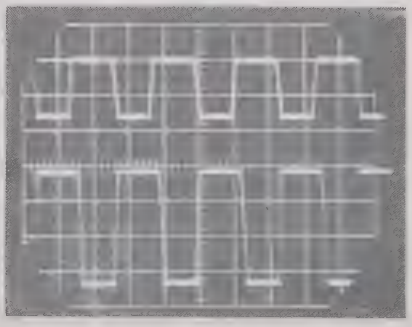


When you intend to make several exposures on one print, only use the graticule light during one exposure and turn it off during the following exposures.

Otherwise you may get pictures with double graticules. (picture 3).



In the oscillogram on the right the graticule light is only used during one exposure, thus obtaining the right picture.



XII. Care of prints

Some black and white prints must be coated, see the instruction sheet. Do this soon after they are separated from the negative. If prints are left uncoated for more than a few hours they will begin to streak and fade; in hot, humid atmospheres fading is more rapid.
Coated but not fully dried prints are extremely sticky. If they come into contact with each other, or with any surface, they will stick firmly together.
Never put coated prints in albums with black paper leaves. Do not use paste, or glue, corner mounts, or untested papers.

To write on the back of the prints use a soft pencil and write lightly, only in the areas around the edges.
Colour prints should be mounted to protect them from curling, or being bent and cracked due to rough handling.
Polacolor Print Mounts are supplied with each colour film pack.
Do not try to coat colour prints.
The dyes used to form the colours in the prints are long lasting. Like all dyes, however, they will fade if exposed to bright daylight for long periods of time.

XIII. Ordering film

Film for the PM 9380 must be ordered from the local Polaroid distributor or dealer. For further information about availability of Polaroid film in your area please write to:

Polaroid Corporation
Cambridge, Massachusetts, U.S.A.

Applications
XIV. Introduction

The oscilloscope is a universal measuring instrument which displays the exact waveform of the applied signal as a function of the time and as a function of another signal.
The display provides the engineer with useful information on the behaviour of circuits, components, etc.
The use of the oscilloscope can be further extended by photographic recording of the oscillograms.

Generally speaking, recorded oscillograms are required for the following:

a. evaluation
b. documentation and filing of results
c. assembly of data obtained during experiments for further reference
d. convenient form for circulation of results to those interested, for lecture work and publication.

The camera PM 9380, combined with suitable adaptors for various oscilloscopes, offers a very convenient method of recording oscillograms. With this camera well-defined recordings of oscillograms are quickly obtained.

PHOTOGRAPHIC RECORDING OF OSCILLOGRAMS

XV. The spectral energy distribution of the fluorescent screen

The electrons of the electron beam, themselves invisible to the eye, strike the fluorescent layer of the screen, causing the latter to fluoresce; the kinetic energy is converted into light energy.
The aim is to achieve the maximum possible brightness, and this is obtained, in particular, by increasing the impact speed. Modern oscilloscopes are therefore characterised by a high accelerating voltage which is a measure of the luminous spot brightness. In general, an increase of the accelerating voltage in excess of a given value causes no increase in spot brightness worth mentioning. The cause of this is to be sought in the fact that the fluorescent screen, from this limiting potential downwards, exerts a strongly negative charge, so that a repulsion force arises between the screen charge and the electrons arriving in the electron beam. A very thin aluminium foil placed behind the fluorescent layer prevents this.

This layer of course demands a minimum voltage so that it can be penetrated by the electrons. It has moreover the additional advantage that it acts as a mirror to a great part of the fluorescent light which otherwise would be diverted to the inside of the tube and hence be lost to the eye of the observer; the brightness of the picture is increased.
For the photographic recording there is still another advantage.
The metallic screening prevents the reddish light of the cathode from penetrating forwards. That is of particular importance when the camera shutter must be opened for a relatively long time before the recordings are made, as for instance when photographing non-recurrent processes with a highly sensitive photographic material. For visual observation, screens with a weak persistence are suitable as these are not much subject to flicker; for photographic recording, screens of a very short persistence should be used. Long persistence is however very advantageous for short-lived, non-recurrent processes. The spectral sensitivity of the photographic material must be adapted to the spectral energy distribution of the fluorescent screen, as this is the only way the highest recording sensitivity can be achieved.

SCREEN PHOSPHORS

PHILIPS description	*International description*	*CIE coordinates* x	y	*Screen colour*	*Persistence duration*
GP	P 2	0.170	0.510	green	medium short
GM	P 7	0.152	0.032	purple blue	medium short
		0.357	0.537	yellowish green	long
BE	P 11	0.139	0.148	blue	medium short
		0.164	0.015	purple blue	very short
GH	P 31	at great brightness			
		0.193	0.386	bluish green	medium short
		0.245	0.523		
		at low brightness		green	

From fig. 1 and the accompanying table can be seen the colours and frequencies with which the various fluorescent screens show a maximum of light. The greenish persistent screens do so when λ = 550 nm, the blue persistent BE screen when λ = 450 nm, the persistent light is strongest at λ = 550 nm.

For visual observation a greenish fluorescent screen (GH and GP screens) is particularly suitable; the blue persistent screens are advantageous for photographic recording.

BE and GH screens decay very quickly, after 100 μs the brightness has already dropped to 1% of the initial level.

It is quite different in the case of the GM screen. The persistent brightness drops steeply at first, but then the actual persistence begins (after 3 s to about 1%). In a darkened room a picture can still be recognised after 30 s and it takes minutes before it disappears completely.

How long persistence is perceptible depends to a great extent on the brightness of the environment. Room lighting falling on the screen reduces the contrast and apparently the persistence time. With suitable filters, on the other hand, the contrast can be increased

1 bluish purple
2 purple blue
3 blue
4 greenish blue
5 blue green
6 bluish green
7 green
8 yellowish green
9 yellow-green
10 greenish yellow
11 yellow
12 yellowish orange
13 orange
14 orange-pink
15 reddish orange
16 pink
17 red
18 purple pink
19 purple red
20 red purple
21 reddish purple
22 purple

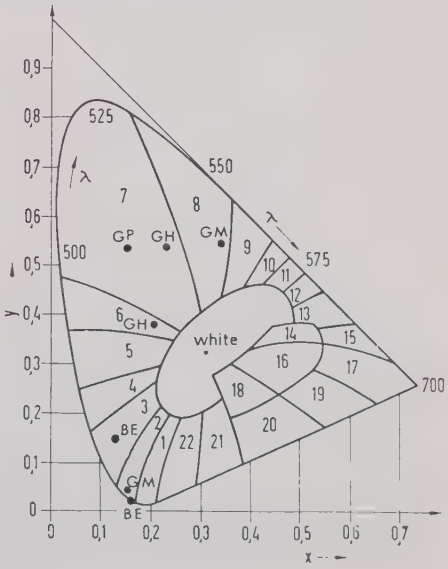


Fig. 1. Colour diagram with x—y coordinates of the Philips fluorescent screens drawn in.

XVI. How to interpret the spectral response curve of the film

In the graphs, the base represents the visible portion of the spectrum with the various colours identified according to their wavelength in nanometers (one millimicron or 10 Angstrom units).
The visible part of the spectrum extends approximately from 400 to 700 nm. Below approx. 400 nm is the ultraviolet region and at approx. 700 nm starts the infrared region. Although invisible, ultraviolet and infrared are important photographically.
The solid line in Fig. 2 and Fig. 3 indicates the relative sensitivity of the film (Type 107) to light of different colours (wavelengths) as measured against the vertical column, which is calibrated on a logarithmic scale. The higher the line, the greater the sensitivity of the film to that particular colour. The other curves in both figures indicate the spectral energy distribution of several Philips fluorescent screens.
The film, Type 107, which is sensitive to all colours is called "panchromatic".
The curves in both figures show that film Type 107, is very sensitive when the fluorescent screens have their maximum light output.

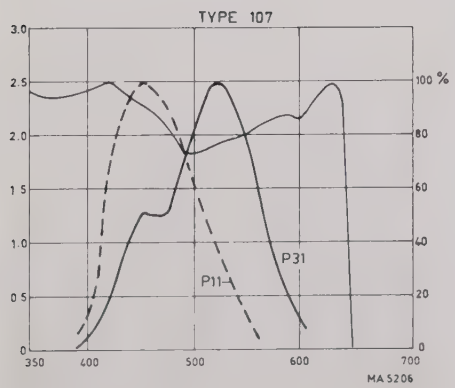


Fig. 2

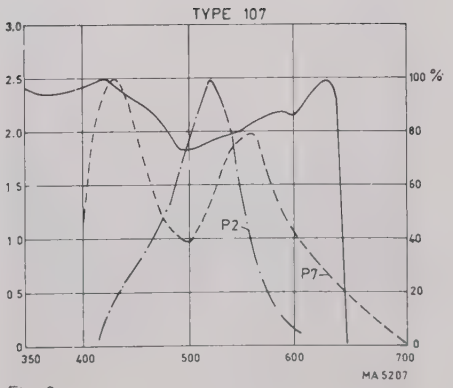


Fig. 3

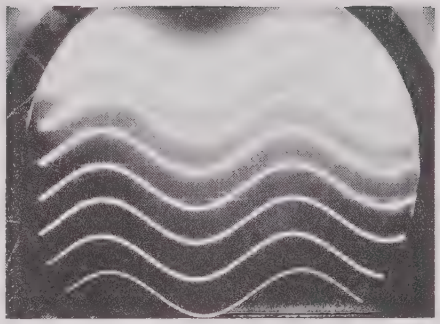


Fig. 4. Exposures over a wide range produce acceptable pictures.
Aperture settings, reading from top to bottom, f/4.5, f/5.6, f/8, f/11, f/16, f/22, f/36, and f/45. Shutter speed constant at 1/30 sec.

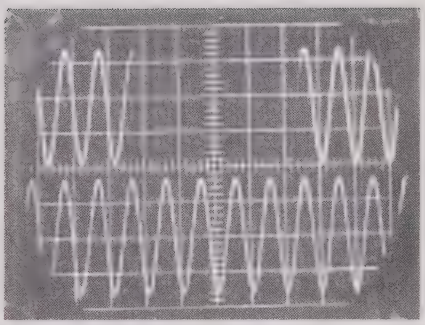


Fig. 7. Part of top trace was lost because the shutter was not open long enough. Keeping the shutter open longer, results in uniform intensity of the lower trace.

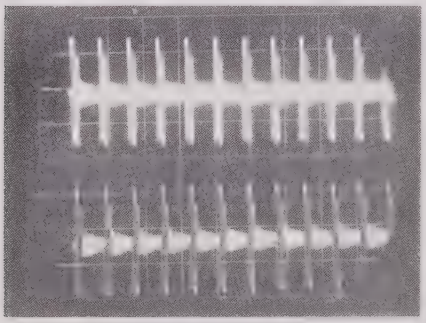


Fig. 5. Top trace overexposed at f/4.5, 1/15 sec. Lower trace slightly under exposed at f/8, 1/60 sec.

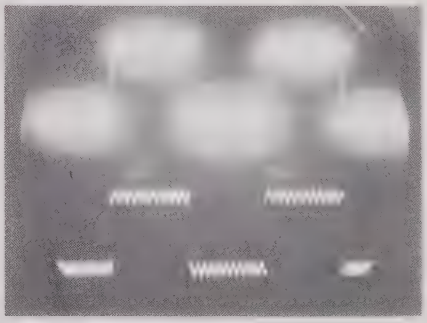


Fig. 8. Trace exposed to show rise time while losing detail on flat top. Exposure decreased to show flat top.

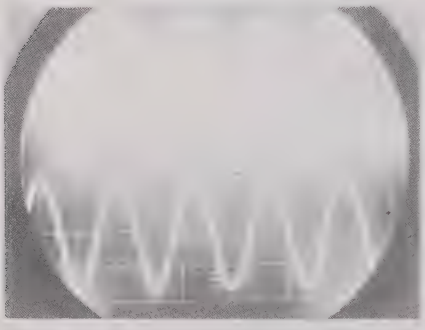


Fig. 6. Blooming of the top trace (as it appeared to the eye) is eliminated in bottom trace by deliberate under-exposure.

XVII. Camera and oscilloscope settings

The more an engineer knows about the effects of camera settings, oscilloscope settings and of the signal waveforms, the more he can save time and film.
This knowledge can help him to select the best exposure for a given trace.

CAMERA SETTING

The camera PM 9380 has, like most cameras, conventional shutter and aperture settings.
Its f/numbers range from f/4.5 to f/45.
The f/numbers listed on the lens are in such a progression, that, with each increase in f/number the amount of light reaching the film is cut in half.
Similarly, the shutter speeds are marked on the lens, they range from 1 sec to 1/125 sec.
Just as in convential photography if the shutter speed is doubled, for example from 1/30 to 1/60 and, simultaneously, the aperture setting is changed from f/8 to f/5,6, there is no change in the exposure (total light reaching the film).
The exposure of the film is the product of the size of the opening through which the light reaches the film and the space of time the shutter is open.
Changing the exposure by a factor of two, doubling or halving either aperture or time, changes exposure by one "stop".
The "B" or bulb setting and the "T" or time setting are most often used in recording single transients.
It is required to hold the shutter open and wait for the transient to appear. Exposure for single transients is usually controlled by varying only the aperture setting.

RANGE OF EXPOSURES

For most repetitive traces, an acceptable picture of a trace is usually possible within a range of exposure settings of four to six "stops". All of the traces in fig. 4 were taken with the same beam intensity, set for comfortable viewing.
Notice that with a maximum exposure (upper trace) the film begins to record spot halo.
The trace appears to "bloom" as if the intensity is too high. From this blooming trace to the other extreme, a too-faint trace, there are about six stops.
A medium intensity trace, when overexposed, does appear to bloom, while an underexposed trace will indicate fine details. This problem is illustrated in fig. 5.
Incidentally, when the intensity setting is too high and visible blooming actually appears on the tube screen it can be reduced in the picture by cutting down the exposure, as illustrated in fig. 6.

APERTURE AND SHUTTER SPEEDS

In all the examples given, different effects on the film can be obtained by varying together shutter speed and aperture controls. Each can be changed to compensate for required changes in the other. Together, they cover a wide range of exposures needed to record variations in image intensities with different films.
In general, aperture control is the only variant used in recording transients, because the shutter is usually held in the "Bulb" or "Time" setting.
It is desirable for both transients and stationary traces to keep aperture to a minimum for sharper focus and less optical distortion.
When recording continuously varying traces, signals with a slow jitter, and signals requiring very low sweep repetition rates, a precise selection of the shutter speed is a first requisite.
When very low sweep rates are used, the camera shutter must remain open for at least the time of one sweep, or an undesired blank space may occur in the recording. Even if the shutter is open slightly longer than the sweep duration, uneven exposure of the trace may result, as shown in fig. 7.
Take as a general rule for uniform recording, that the exposure time should come to at least five to ten times the sweep duration.

OSCILLOSCOPE SETTINGS AND THE SIGNAL

Intensity.
The intensity setting on the oscilloscope controls the beam current and, thus, can have the greatest effect on proper photographic exposure. Slight changes in intensity settings, almost unnoticeable to the eye, can have the same effect as the change of one or two "stops" in camera settings. However, the film latitude yields good exposures within a wide range of intensity settings.

Spot speed.

The exposure produced by the spot varies inversely to the spot writing speed. As the speed of the spot increases, more exposure or higher intensity may be required.
When recording traces with peaks, one must remember that the spot speed decreases near the peaks. The exposure must be selected to catch the interesting portion of the trace. In figure 8, a portion of the trace is deliberately under-exposed to increase detail in another portion.

Similarly, increasing the amplitude of either axis will increase the spot speed and lower the brightness. A trace, four centimeter from peak to peak, may require four times as much exposure as one which is one centimeter high.

The choice of optimal exposure values is made, at first, by trial and error. But it very soon becomes almost intuitive.
As a rough guide for first exposures, the following can be used:
For film, Type 107, f/8 at 1/60 sec.

XVIII. Phosphors and filters

Polaroid Land films are recommended for recording with all the commonly used tube phosphors.

Therefore an engineer is wise to know the effects of different phosphors and filters on his film.

The phosphors, P2 and P7 (GP and GM) have different color outputs in the initial fluorescence and in the afterglow. The light output of some phosphors makes them better suited for photographic recording than others. For example the P11 (BE) screens are the best ones for recording high speed transients. Of the phosphors intended primarily for visual work, the P1 and P2 are effective for stationary patterns and low speed transients.

Filters – green, amber and blue – are commonly furnished by oscilloscope manufacturers to separate the initial fluorescence and afterglow and to aid the observer during extended observations. A blue filter is used to eliminate cathode glow on unaluminized phosphors and for cutting out the long-persistence yellow afterglow on P2 and P7 screens.

A yellow filter damps the purple-blue excitation light, the yellowish green persistence is increased however.

In general, a filter absorbs a considerable amount of light and can cause slight degradation in image quality from surface interreflection.

A standard blue filter for example, will require an additional exposure of from 2 to 2½ stops.

A brief description of tube phosphors, their use with filter and their application in photography are presented here.

P2. Versatile, especially for tubes with high accelerating voltages. It has initial fluorescence and afterglow. The blue-green fluorescence is efficient for photography. A blue filter can be used to eliminate the yellow afterglow which can cause blurring with moving traces. Before taking pictures, it is necessary to remove any amber filter used for long persistence observations, because the initial fluorescence is most actinic for recording. The P2 screen is not recommended for recording high speed transients.

P7. Similar to the P2, with an initial blue fluorescence and a yellow afterglow. A P7 screen has greater persistence at lower accelerating voltages and can be used for seeing as well as recording stationary patterns and low speed transients. (The P2 is a mixed phosphor screen while the P7 screen consists of a blue fluorescent layer and a yellow persistence layer.) The relatively low fluorescent output and high afterglow make this phosphor not as desirable as P2 for photo recording of transients. A blue filter can be used for recording only the initial actinic blue fluorescence. The amber filter (for visual comfort) should be removed before photo recording.

P11. Highest actinic output with short persistence makes it most valuable for recording steady state patterns as well as high speed transients.

A blue filter is used for visual work but not for photographic purposes except to reduce cathode glow fog.

XIX. Maximum writing rate

The term "maximum writing rate" is used to indicate the sensitivity of a particular film for recording transients. Maximum writing rate specifies the maximum linear speed of the oscilloscope spot, in a single traverse, that can produce a barely readable record on a film for a particular combination of oscilloscope, camera, and settings.
Maximum writing rate is, in a sense, analogous to the ASA exposure index, which is used to indicate the sensitivity of a film for recording daylight scenes. Exposure and maximum writing rate, however, are not necessarily related.
Most important, ASA exposure indications are determined from the film's response to daylight or tungsten light, both of which have different spectra from that of any tube phosphor. For very high speed transients, the exposure time is very short (with short persistence phosphors).
For extremely short exposures, the reciprocity relationship of brightness and exposure time fails, and the ASA index loses significance.
Furthermore, the exposure index is a measure of the exposure required to reach a particular contrast gradient in the film's characteristic curve, while readings for maximum writing rates are determined in the threshold region of the characteristic curve of the films. The threshold region on a positive print is the region of deepest black.
There are two ways of increasing the maximum writing rate of the film. All this information can be very useful when a film is being pushed for its maximum sensitivity. Increasing the maximum writing rate will often reveal invisible portions of a fast trace.

a. Prefogging

Controlled marginal exposure of the film to a light source before exposure to the trace will increase the maximum writing rate two to three times as shown in fig. 10. Prefogging is the most effective single method for increasing the maximum writing rate.
Prefogging does not cause as sharp a drop in contrast as underdevelopment, and it is not necessary to prefog to the point of lightening the background significantly.
Easy methods of prefogging are developed by experiment. One can, for example, point the camera at a light wall or a white card with the proper brightness. Film Type 107 should be exposed at f/11 at 1/125 sec. The camera should be far enough away (30 cm is sufficient) so that the texture of the tissue paper or wall etc. is out of focus.

b. Decreasing the development time

Developing prints in only half the time will increase the maximum writing rate. The print is removed from the brown paper 7 to 8 sec. after pulling the yellow tab out of the camera.

The overall background is considerably lighter and contrast is lowered, but details can be seen in parts of a fast trace which would not be visible with the full development time.
This method requires no extra effort and could be used at all times when shooting high speed transients.

Effect of prefogging film Type 107 to increase maximum writing rate.

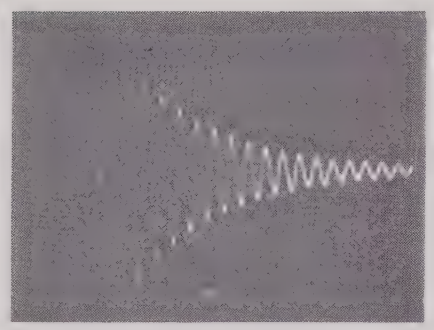


Fig. 9. Transient recorded with no prefogging at f/4.5 at 1 sec.

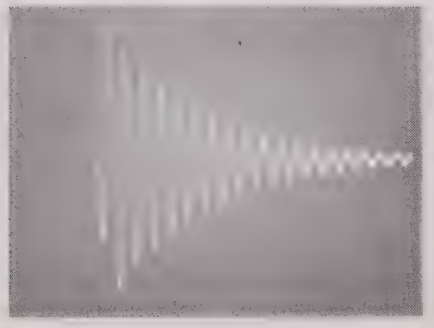


Fig. 10. Prefogged film used for the top transient with the same camera and intensity settings.

Fig. 11. Transient of figure 9 only developed for 7 sec. to increase the maximum writing rate.

XX. Multi-exposures

The film, Type 107, is suited for making more exposures on one print. This method can be used to compare accurately two or more signals which have to be displayed on a single beam oscilloscope.
8 to 10 exposures ca be shot on a single print this depends on the amplitude of the recordec signals.
When the time of several signals is compared it is necessary to trigger the time base generator of the oscilloscope on the same signal.
With this multi-exposure method also graphs of signals can be made, the amplitude of which depends on three other amplitudes. (f.e. transistor curves.)
After the first exposure, turn off the graticule illumination. Do not readjust V/div. and T/div. switch and X shift, thus obtaining the right relationship between the signals.

CLOSE-UP PHOTOGRAPHY

The camera body and lens unit of the PM 9380 can be combined with the accessories that make up the Polaroid CU-5 Close-up Land camera system for close-up photography.
Close-up photographs can be made instantly in Colour or Black and White to record small objects such as electronic circuitry, laboratory setups and medical specimens.
A variety of frames and an interchangeable 5" (127 mm) lens enable pictures from ¼ lifesize to 3 x magnification.
Built-in electronic ring flashes powered by plug-in AC or DC battery power packs, provide even, consistent illumination without special exposure control.

POLAROID CU-5 CAMERA COMBINATIONS

¼ : 1 to ¾ : 1 Pictures

88-1 Camera body
88-5 5" Lens Unit
88-53 6 x 7¾ Framing Kit (for ½ : 1 pictures)
88-9 220-240 volt AC Power Pack

1 : 1 Pictures

88-1 Camera body
88-3 3" Lens Unit
88-11 1 : 1 Frame
88-9 220-240 volt AC Power Pack

2x Pictures

88-1 Camera body
88-7 Ratio Multiplier
88-3 3" Lens Unit
88-21 2X Frame
88-9 220-240 volt AC Power Pack

3x Pictures

88-1 Camera body
88-7 Ratio Multiplier
88-3 3" Lens Unit
88-31 3X Frame
88-9 220-240 volt AC Power Pack

¼ : 1 to ¾ : 1 Accessories

88-51 11½ x 15 Framing Kit (for ¼ : 1 pictures)
88-25 25" Viewfinder (for ¼ : 1 pictures without framing kit)
88-52 8½ x 11 Framing Kit for ⅓ : 1 pictures)
88-54 4 x 5½ Framing Kit (for ¾ : 1 pictures)

Other Accessories

88-60 Filter Clip (Series VI)
88-65 Universal Mount
88-70 Fitted Carrying Case
88-19 "Y" Cord
88-40 Polarizing Filter
88-8 115 volt AC Power Pack

Accessories mentioned above must be ordered directly from Polaroid distributors.
When ordering indicate numbers and designations listed above.

Maintenance

XXI. General

The mechanism of the PM 9380 is strong and should be trouble free. The preventive maintenance described below will eliminate potential difficulties. If a serious fault occurs, the camera should be sent to a Polaroid Repair Station (see list on page 37).

If there is no Polaroid Repair Station in your country, send the camera to:

POLAROID EUROPE
24 MARKT, ENSCHEDE
NETHERLANDS

XXII. Cleaning

Do not attempt to disassemble the camera.
Do not oil any part of the camera.
Rollers: Inspect the steel rollers frequently, preferably before loading each new film, and especially after any period of extensive heavy use. If the rollers show signs of dirt, dried developer, or lint, swing out the assembly (page 7) and clean them.

Scrape off any dried developer with a bit of cardboard or a matchstick. Never use your fingernail or anything metallic. Wipe the rollers with a damp cloth and dry them. Then swing the roller assembly back into place.

Lenses: To remove dust, hold the lens unit so that the lens points down, and use a camel's hairbrush. Breathe on the lens to dampen it and gently wipe it with a clean, dry absorbent cotton, wrapped around a soft object.
Never use silicone coated eyeglass tissues to clean the lenses.

Shutter: The mechanism should be exercised at all speeds periodically (at least three times a year) to prevent it from sticking because of inactivity.

XXIII. Guarantee

Your PM 9380 camera has been thoroughly tested and inspected before shipment. All parts are guaranteed against defects in materials for one full year from the date of delivery.

During this period any defects on the camera body and the lens unit will be remedied by the Polaroid Corporation without charge, except for transportation.

All other components are covered by the warranty for the PHILIPS equipment you are using. For further information contact your nearest approved PHILIPS dealer.

XXIV. Servicing

Damage to the Polaroid camera body and lens unit resulting from normal wear, mishandling or accident will be promptly repaired at a reasonable charge.
Pack the unit carefully in a **stiff** container with plenty of padding and ship it prepaid to the appropriate address below.

AUSTRALIA
Polaroid Australia Pty. Ltd.
2 Smail Street
Ultimo, N.S.W.

BELGIUM
Polaroid (Belgium) S.A.
12-16 Rue de la Victoire
Brussels 6

ENGLAND
Polaroid (U.K.) Ltd.
Office, Rossanne House
Welwyn Garden City, Hertfordshire
Repairs, Huggins Lane
Welham Green, near Hatfield
Hertfordshire

FRANCE
Polaroid (France) S.A.
57, Rue de Villiers
92-Neuilly sur Seine

GERMANY
Polaroid GMBH
Königslacher Strasse 15-21
6 Frankfurt/Main-Niederrad 1

ITALY
Polaroid (Italia) S.p.A.
Via dei Cignoli 9
20151 Milan

JAPAN
Nippon Polaroid Kabushiki Kaisha
Mori Bldg. No. 6
32, Nishikubo Tomoe-cho
Shiba, Minato-ku, Tokyo

THE NETHERLANDS
Polaroid (Nederland) N.V.
Office, Maassluisstraat 258
P.O. Box 9167, Amsterdam-W. III
Repairs, 24 Markt, Enschede

SWITZERLAND
Polaroid A.G.
Hardturmstrasse 175
Zurich 8037

For all other countries: Send the camera to

POLAROID EUROPE
24 MARKT, ENSCHEDE
THE NETHERLANDS

Sales and service all over the world

Alger: Sadetel, 41 Rue des Frères Mouloud Alger, tel. 656613–656607

Argentina: Philips Argentina S.A., Cassila Correo 3479, Buenos Aires, tel. T.E. 70, 7741 al 7749

Australia: Philips Electrical Pty Ltd., Philips House, 69-79 Clarence Street, Box 2703 G.P.O., Sydney, tel. 2.0223

België/Belgique: M.B.L.E., Philips Bedrijfsapparatuur, 80 Rue des Deux Gares, Bruxelles; tel. 02/13 76 00

Bolivia: Industrias Bolivianas Philips S.A. LA Jón postal 2964 La Paz tel. 50029

Brasil: S.A. Philips Do Brasil; Avenida Paulista 2163, P.O. Box 8681, Sao Paulo S.P., tel 81–2161

Burundi: Philips S.A.R.L., Avenue de Grèce, B.P. 900, Bujumbura

Canada: Philips Electronic Industries Ltd., Scientific and Electronic Equipment Division, Philips House, 116 Vanderhoof Avenue, Toronto 17 M 4G 2JI. tel. (416)-425-5161.

Chile: Philips Chiléna S.A., Casilla 2687, Santiago de Chile; tel. 94001

Colombia: Industrias Philips de Colombia S.A., Calle 13 no. 51-03, Apartado Nacional 1505, Bogota; tel. 473640

Costa Rica: Philips de Costa Rica Ltd., Apartado Postal 4325, San José; tel. 210111

Danmark: Philips Elektronik Systemer A/S Afd. Industri & Forskning, Strandlodsvej 4 2300-København S; Tel (0127) AS 2222; telex 27045

Deutschland (Bundesrepublik): Philips Elektronik Industrie GmbH, 35 Kassel-Bettenhausen, Miramstrasse 87; tel. (0561) 501521.

Ecuador: Philips Ecuador S.A., Casilla 343, Quito; tel. 239080

Egypt: Ph. Scientific Bureau 5 Sherif Str. Cairo – A.R. Egypt P.O. Box 1807; tel. 78457-57739

Eire: Philips Electrical (Ireland) Ltd., Newstead, Clonskeagh, Dublin 14; tel. 976611

El Salvador: Philips de El Salvador, Apartado Postal 865, San Salvador; tel. 217441

España: Philips Ibérica S.A.E., Avenida de America, Apartado 2065, Madrid 17; tel 2462200

Ethiopia: Philips Ethiopia (Priv. Ltd. Co.), P.O.B. 2565; Cunningham Street, Addis Abeba; tel. 48300

Finland: Oy Philips Ab, Postboks 10255, Helsinki 10, tel. 10915

France: Philips Industrie, Division de la S.A. Philips Industrielle et Commerciale 105 Rue de Paris, 93 002 Bobigny; tel. 830-11-11

Ghana: Philips (Ghana) Ltd., P.O.B. M 14, Accra; tel. 66019

Great Britain: Pye Unicam Ltd., York Street, Cambridge; tel. (0223) 58866

Guatemala: Philips de Guatemala S.A., Apartado Postal 238, Guatemala City; tel. 64857

Hellas: Philips S.A. Hellénique, 54 Ave Syngrou, Athens, tel 230476, P.O. Box 153

Honduras: Hasbun de Honduras Apartado Postal 83, Tegucigalpa, tel. 2-9121 5

Hong kong: Philips Hong Kong Ltd., P.O.B. 2108, St. George's Building, 21st floor, Hong Kong, tel. 5-249246

India: Philips India Ltd., Shivsagar Estate, Block "A", Dr. Annie Besant Road, P.O.B. 6598, Worli, Bombay 18, tel. 370071

Indonesia: P.T. Philips Development Corporation, Jalan Proklamasi 33, P.O.B. 2287, Jakarta; tel. 51985-51986

Iran: Philips Iran Ltd., P.O.B. 1297, Teheran, tel. 662281

Iraq: Philips Iraq W.L.L. Munir Abbas Building 4th Floor, South Gate, P.O. box 5749 Baghdad, tel. 80409

Island: Heimilistaeki SF, Saetún 8, Reykjavik; tel. 24000

Islas Canarias: Philips Ibérica S.A.E., Triana 132, Las Palmas; Casilla 39-41, Santa Cruz de Tenerife

Italia: Philips S.p.A., Sezione PIT; Viale Elvezia 2, 20052 Monza; tel. (039) 361-441; telex 35290

Kenya: Philips (Kenya) Ltd., P.O.B. 30554, Nairobi; tel. 29981

Malaysia: Philips Malaya Sdn Bhd. P.O. Box 332, Kuala Lumpur,/Selangor W. Malaysia; tel. 774411

Mexico: Philips Comercial S.A. de C.V., Uruapan 7, Apdo 24-328, Mexico 7 D.F.; tel. 25-15-40

Nederland: Philips Nederland B.V., Boschdijk, Gebouw VB, Eindhoven; tel. 793333

Ned. Antillen: N.V. Philips Antillana, Postbus 523, Willemstad; tel. Curaçao 36222-35464

New Zealand: Philips Electronical Industries (N.Z.) Ltd., Professional and Industrial Division, 70-72 Kingsford Smith Street, P.O.B. 2097, Lyall Bay, Wellington; tel. 73-156

Nigeria: Philips (Nigeria) Ltd., 6 Ijora Causeway, P.O.B. 1921, Lagos; tel. 45414/7

Nippon: Nihon Philips Corporation, P.O.B. 13, World Trade Center, 32nd Floor, Tokyo 105; tel. (03) 435-5211

Norge: Norsk A.S. Philips, Postboks 5040, Oslo; tel. 463890

Österreich: Oesterreichische Philips Industrie GmbH, Abteilung Industrie Elektronik, Partartgasse 32, A-1230 Wien; tel. (0222)-831501.

Pakistan: Philips Electrical Co. of Pakistan Ltd., El-Markaz, M.A. Jinnah Road, P.O.B. 7101, Karachi; tel. 70071

Paraguay: Philips del Paraguay S.A., Casilla de Correo 605, Asuncion, tel. 8045-5536-6666

Perú: Philips Peruana S.A., Apartado Postal 1841, Lima; tel. 326070

Philippines: Philips Industrial Development Inc., 2246 Pasong Tamo P.O.B. 911, Makati Rizal D-708 tel. 889453 to 889456

Portugal: Philips Portuguesa S.A.R.L., Av. Eng.° Duarte Pacheco, 6 – Lisboa – 1

Rwanda: Philips Rwanda S.A.R.L., B.P. 449, Kigali

Saoudi Arabia: A. Rajab and A. Silsilah P.O. box 203 Jeddah - Saudi Arabia; tel. 5113-5114

Schweiz-Suisse-Svizzera: Philips A.G., Binzstrasse 15, Postfach 8027, Zurich; tel. 051-442211

Singapore: Philips Singapore Private Ltd. P.O. Box 340, Toa Payoh Central Post Office, Singapore 12; tel. 538811

South Africa: South African Philips (Pty) Ltd., P.O.B. 7703, 2, Herb Street, New Doornfontein, Johannesburg; tel. 24-0531

Sverige: Svenska A.B. Philips, Fack, Lidingovägen 50, Stockholm 27; tel. 08/635000

Syria: Philips Moyen-Orient S.A. Rue Fardoss 79 Immeuble Kassas and Sadate B.P. 2442 Damas; tel. 18605-21650

Taiwan: Yung Kang Trading Co. Ltd., San Min Building, Gnd Floor, 57-1 Chung Shan N Road, 2 Section, P.O.B. 1467, Taipei; tel. 577281

Tanzania: Philips (Tanzania) Ltd., Box 20104, Dar es Salaam; tel. 29571

Thailand: Philips Thailand Ltd., 283, Silom Road, Bangkok; tel. 36980, 36984-9

Turkey: Türk Philips Ticaret A.S., Posta Kutusu 504, Beyoglu; Gümüssuyu Caddesi 78/80 Istanbul 1 Turkye

Uganda: Philips Uganda Ltd. p.o. Box 5300 Kampala; tel. 59039

Uruguay: Industrias Philips del Uruguay, Avda Uruguay 1287, Montevideo; tel 915641 Casilla de Correo 294

U.S.A.: Philips Test and Measuring Instruments Inc.; 400 Crossways Park Drive, Woodbury, N.Y. 11797; tel. (516) 921-8880

Venezuela: C.A. Philips Venezolana, Apartado Postal 1167, Caracas; tel. 360511

Zaire: Philips S.Z.R.L., B.P. 1798, Kinshasa; tel. 31887-31888-31693

Zambia: Philips Electrical Ltd., Professional Equipment Division, P.O.B. 553 Kitwe; tel. 2526/7/8; Lusaka P.O. Box 1878

760101

For information on change of address:
N.V. Philips
Test and Measuring Instruments Dept.
Eindhoven - The Netherlands

For countries not listed:
N.V. Philips PIT Export Dept.
Test and Measuring Instruments Dept.
Eindhoven - The Netherlands

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